

Developing a Soil Monitoring System following regional and European policies - case of Wallonia, Southern Belgium

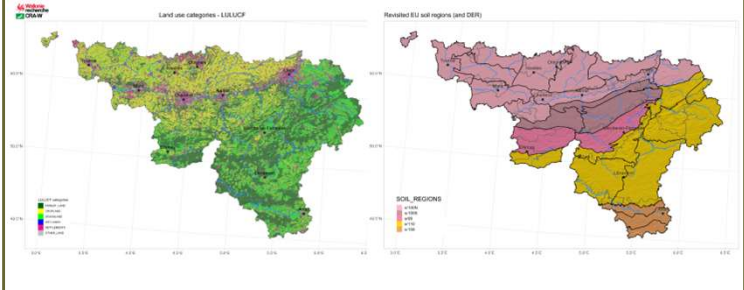
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Context

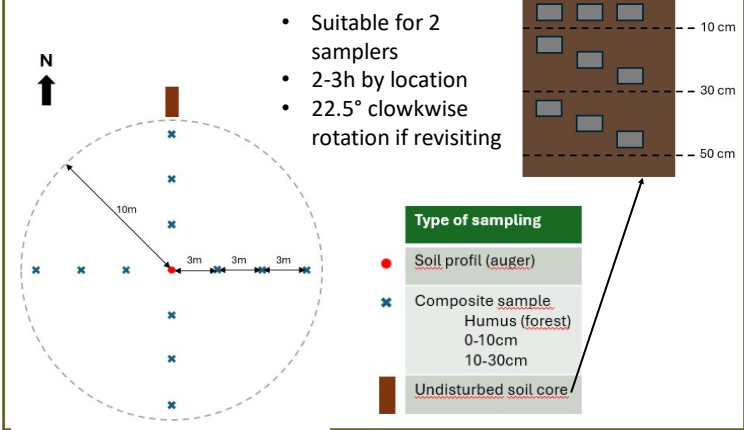
- Human activities and climate change threaten soils through many degradations: erosion, compaction, loss of OM and biodiversity, pollution, etc.
- Assessing soil health and its capacity to provide Ecosystem Services (ES) will allow Public Services to act to improve Walloon soils protection.
- A Soil Monitoring System is currently under development : the **Walloon Soil Monitoring (WSM)** will integrate **all land uses and occupations**.
- Descriptors, sampling schemes, protocols in-field and in laboratories are selected **considering the Walloon Soil Decree, the LULUCF regulation and the upcoming Soil Monitoring Law (SML)**.

1. Sampling network design

- Random stratified sampling following the criteria proposed in the **SML**:
- SOIL UNITS (SU)** defined by **LULUCF categories & european soil regions**.
 - Number of sites and their locations by SU assessed through a geostatistical analysis based on existing rasterised data
→ (SOC and N contents, pH, Bulk Density, clay, silt and sand, etc...)



3. Field sampling scheme



2. Selection of the soil descriptors

- Chemical and physical descriptors:**
based on LULUCF regulation and upcoming Soil Monitoring Law
- Biological descriptors:**
based on scoring: maturity, standardization, commonly used in SMN, representativeness of ES, methodological practicality, complementarity and cost, and the SML requirements

Descriptor	Standard method	Methodological practicality, reference	Common in SMN/other	Descriptor of EF	Global score	Ab / Div / Act / Laboratory location Cost	Field campaign 2025
	5: standard 4: non-standard but common 3: in progress 2: early stage	5: 18 SMN 4: 6-7 SMN 3: 4-5 SMN 2: 2-3 SMN 1: 0-3 SMN	5: 4 FE 4: 3 FE 3: 2 FE 2: 1 FE 1: 0 FE	5: 17-19 4: 15-16 3: 13-14 2: 11-12 1: 6-10 + if red	Complementarity and feasibility	Green: analysed in 2025 Yellow: analysed if budget/time Red: rejected for SMN	
Acari : visuel		2	2	3	12	---	
Activité enzymatique : Biolog		3	3	3	15	---	
Arthropode : visuel		2	3	3	11	---	
Azote potentiellement minéralisable		3	3	2	17	---	
Bactérie : ADN métabarcoding		4	3	4	16	---	
Bactérie : qPCR ADN 16s		4	3	4	16	---	
Biomasse microbienne : extraction moléculaire ADN		4	4	1	13	---	
Biomasse microbienne : fumigation		4	4	1	16	---	
CO stable : CO dans la fraction < 20µm		2	1	2	11	---	
Collembole : visuel		2	3	3	13	---	
Diatomées		3	3	2	15	---	
Enchytraeids : visuel		2	2	3	12	---	
Eucaryotes : ADN métabarcoding		3	2	4	14	---	
Fungi : ADN métabarcoding		3	2	4	14	---	
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→ Bio-descriptors tested: microbial biomass & respiration, fungi and bacteria qPCR & metabarcoding, eucaryote metabarcoding, nematode

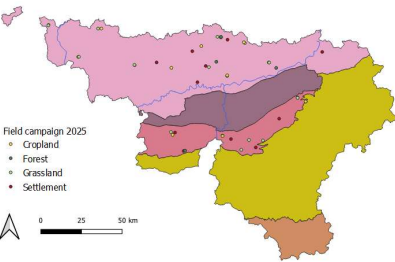
4. Adaptation of the local laboratory network

- Towards a fluid and rigorous processing chain from field sampling to laboratory analysis.
- Supporting provincial laboratories in developing and expanding their analytical services (new physical and biological indicators)
- Proposing reference values for the new indicators, with associated soil management advice, to encourage private clients in adopting these new parameters and thus feed and improve the WSM database.

Progress and challenges encountered

First tests on **2 Soil Regions**
Silty soil
Silty-stony soil (shade and limestone)

46 sites sampled in 4 months
Cropland 14
Forest 4
Grassland 17
Settlement 11



- Defining a sampling period that meets soil biology requirements while allowing sufficient sampling throughout the year.
- Adapting the local processing chain and logistic for the analysis of fresh soil samples.
- Finding suitable equipment for collecting sufficient material in stony and shallow soils, and for collecting sufficient humus in forest land.
- Time-consuming and physically demanding sampling. Consideration of:
 - Mechanisation;
 - Equipment optimisation.
- Little preexisting knowledge on Walloon soil biology to support the sampling design and computation of reference values in all land-uses.

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